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OF CEYLON

Edited by

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St. Coombs, Talawakelle.

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NOTE.

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EDITORIAL.

FERTILISERS

The outbreak of war has necessarily resulted in a dislocation of fertiliser supplies, particularly in regard to inorganic nitrogenous ingredients such as ammonium sulphate. In this issue will be found a report of a lecture given by Dr. Eden before the Dimbula Planters' Association reviewing the general position.

The Institute has been in close touch with the firms supplying fertilisers and now receives frequent reports from these firms and from the Customs authorities in regard to the supplies of fertilisers arriving in Ceylon. A meeting was also held in Colombo when the various interests concerned were all represented and it was possible to reach agreement as to the general principles which should govern the utilisation of existing and forthcoming stocks in order to obtain, so far as possible, some stability in regard to costs.

Owing to unfavourable weather conditions the consumption of fertilisers was somewhat below normal in the earlier part of the year and in consequence the stock position at the outbreak of war was rather better than the import figures suggested. The embargo on the export of nitrogen from the United Kingdom which was imposed at the beginning of the war made it obvious however that some degree of substitution by organic nitrogen would be necessary, and one of the most important points discussed was the degree to which this ought to be carried out. Initially it was considered advisable to reduce the proportion of ammonium sulphate in mixtures by some 50 per cent. This proportion will necessarily fluctuate to some extent, depending on what supplies are received. Actually the position in regard to the release of ammonium sulphate from the United Kingdom remains obscure though it is satisfactory to note that 1,000 tons of this material were received from Belgium in the month of November.

The balance of nitrogen will have to consist to a considerable extent of organic manures such as groundnut cake, fish and similar materials. These are however more expensive both in regard to the cost per unit of nitrogen and also in transport, since a larger bulk has to be used to supply the same amount of plant food. Fortunately a certain amount of nitrate of soda has recently been received and there is no reason why a reasonable quantity of this material should not be used in tea mixtures in order to reduce costs.

The Institute is, as already mentioned, maintaining close touch with the fertiliser firms on the whole question and will be glad to assist tea estates by commenting on alternative mixtures to replace pre-war manurial programmes.

FOOD PRODUCTION

Nursery trials with Maize, Kurakkan, Adlay, Bulrush Millet, Hill Paddy (seven varieties), Soya Bean (two varieties) and Cow-pea are in progress at St. Coombs so that information may be gathered in regard to seed rates, productivity, time of maturation, etc. Two acres of patna land will shortly be opened up in sweet potatoes and, probably, soya bean. These crops will in due course be followed by a suitable rotation. Later when further information is available, the question of opening a larger area will come up for renewed consideration. Much uncertainty unfortunately still remains as to the feasibility of economic food production on up-country tea estates, not only in regard to what can be grown at higher elevations, but also as to the disposal of any crops produced. It is felt, therefore, that it would be premature for the Institute to embark immediately on any large scale scheme and that its most useful function will be to obtain information on different crops for the guidance of estates.

FIRING OF TEA

The first of a new series of papers dealing with the firing of tea is given in the present number. In this connection, it may be of interest, considering conditions imposed by the war, to refer readers to previous articles on Fuels for Tea Dryers which have appeared in *The Tea Quarterly* and to which references are given in Mr. Lamb's paper, and in particular to the "Ready Reckoner" given in the fourth of the previous papers.

PHLOEM NECROSIS RESEARCH

After some delay due to war conditions, it is hoped that an additional senior staff research officer for work on *Phloem necrosis* will be available early in the new year. The appointment has been offered to Dr. T. E. T. Bond, M.Sc. (Reading), Ph.D. (Cantab.), at present Lecturer in Botany in the University of Aberdeen.

TEA RESEARCH INSTITUTE PUBLICATIONS

A general index to the publications of the Institute to the end of 1938 has been prepared and will shortly be issued to all those registered to receive this publication.

ROLAND V. NORRIS.

ADDRESS TO THE CEYLON ASSOCIATION IN LONDON*

F. R. TUBBS

When I last addressed you in 1935 you expressed the wish that personal contact between the Staff of the Tea Research Institute and the Ceylon Association in London should be maintained when our presence in England permitted it. Accordingly I am here again today to take advantage of the opportunity you have provided of explaining to you the present trends of research in my department.

As you are aware, the problem I was given on joining the staff of the Institute was to investigate the growth of the tea bush under different conditions with a view to solving certain difficulties with which the practical planter was seeking aid. The main line of research was pruning, though a variety of other investigations were also made. When I addressed you in 1935 I was able to outline the progress that had been made. In the succeeding $2\frac{1}{2}$ years further evidence was obtained and, in 1937, a bulletin was published collating all the practical results, with a minimum of scientific detail.

Dr. Norris then discussed with me the future policy of my department. It was recognised that the examination of the various growth responses of the tea bush to pruning and plucking under different climatic conditions could be expanded to cover a lifetime's work, not only for one man but for several. Such further investigations would take years to complete. The question was — "Will the increased knowledge resulting from the continuance of existing lines of research have sufficient further practical value to justify the continued exclusion of work upon the improvement of the *types* of tea bush in cultivation ?" We could, of course, give no assured answer, but we were in complete agreement that, having obtained a working basis for pruning policy, selection work could no longer be delayed. Selection being a whole-time task, work on other lines is, of necessity, being gradually reduced.

The task of improving a crop is no easy one, and is unending. If you think of the decades often required to produce fundamental

* An address given by Dr. F. R. Tubbs, Plant Physiologist, Tea Research Institute of Ceylon, to members of the Ceylon Association in London, in the Council Chamber of the Rubber-Growers' Association (Inc.) 19, Fenchurch St., London, E.C. 3, on Monday, 10th July, 1939.

improvements in annual crops, you will realise the magnitude of such a task where a perennial tree crop like tea is concerned. Tea as grown today is, practically speaking, a mixture resulting from the interbreeding of various wild strains, with the result that, as you are aware, almost every bush is different from its neighbour in its cropping potential, its habit and the composition of the crop obtained from it.

Three major lines upon which active work would be necessary were immediately obvious. There were: first, selection of bushes offering possibilities of combining high yield and quality; secondly, the propagation of selected bushes for test and for commercial purposes; and thirdly, the factors affecting the growth of new bushes in replanted areas.

Before I discuss this further, I will first allude briefly to the visit I paid to India. In 1937 I was sent to the Scientific Department of the Indian Tea Association at Tocklai and to the United Planters' Association of South India with instructions to facilitate as far as possible co-operation between the Indian and Ceylon organisations interested in Tea selection. As far as my work in Ceylon goes, the visit proved to be of material value to me and I am glad to be able to report that Dr. Wight of the Indian Tea Association, Mr. Subba Rao of the United Planters' Association of South India, and I, have kept in close but informal touch since, to our mutual benefit. Such contacts are of the greatest possible value when so large a subject has to be investigated: the information exchanged enables each officer to arrange the foundations of his work more soundly, while informal criticism and suggestion aid and accelerate progress. I would like to acknowledge the generous hospitality received from the staff of the Indian Tea Association and the United Planters' Association of South India, especially Mr. Cooper, and particularly the benefit I received from talks with Dr. Wight upon the mass of work upon the preliminaries to Selection which he had already in hand.

In Ceylon, the first line of work, namely, the selection of desirable bushes, is already in active progress, but it must be realised that it will take years to test the selections and then to multiply them.

Considerable trouble was taken to devise a method of selection for high yield that could be carried out on commercial estates as well as at St. Coombs and I feel that you will be gratified to know that several superintendents have already undertaken such work for the benefit of their estates and that the closest possible touch is kept with them. This question of advice, at the present stage,

is frankly something of a problem to me. Your superintendents naturally ask two questions: (1) "Can you come and see what I have got?" and (2) "Now, which is the type I ought to select for?" While the first question is always answered in the affirmative if at all possible, I have to keep a balance between my work at St. Coombs and my advisory work. This problem is general throughout the Institute and was referred to by Dr. Norris at the last Conference.

While I naturally wish to be able to answer the second question fully, I am unable to do so at present, for it must be remembered that what is wanted is the best type for the individual estate or district. I think it might have a bad effect on the final results were my ideas on type to be universally accepted. At present, we do not know enough to lay down any general rule, and the best advice I can give is "observe what type does best on your estate and select for that." It is on these lines that I think progress will be most rapidly made.

At St. Coombs every field is being carefully combed out for possible high yielders. The process is a long one involving first eye-selection of many thousands of individual bushes and then the recording of yields over varying periods from those chosen. On other estates larger or smaller schemes are in progress, according to the circumstances. Every effort has been made to avoid future disappointment by arranging the schemes on as sound a basis as possible and by emphasising that a long period would elapse before improved material will be available.

It is too early to speak of results, but the success of the Dutch with Cinchona is an example of the possible results of breeding, selection and propagation work — results that fully justified the lengthy period of work and waiting. How long it will be before new strains are produced I cannot say, but it will certainly not occur in the next several years.

This does not mean that economic results are not yet being produced, for the focussing of interest upon the character and vigour of *individual* bushes is already stimulating marked interest in the vigour and uniformity of existing tea seed-bearers and of the seedlings produced from them. It is obviously impossible for officers of the Institute to inspect every seed-bearer area, but at conferences and informal talks I have found that Superintendents are taking the keenest interest in the subject. It is the policy of the Institute to recommend that obviously untypical or weakly seed-bearers be cut out and replaced where necessary by better plants. This policy is designed to secure an improvement in existing seed-supplies during the period that must elapse before selected bearers are in production.

The possibility of budding existing seed-bearers with improved types also demands, and is receiving, attention. An extension of this work to determine whether the use of other species of camellia as stocks will enable us to obtain seed more quickly from new plantations is also very desirable.

Certain estates have adopted long range plans designed to produce several seed-bearer areas that will be progressively discarded as more and more strictly selected bearers become available. The first area consists of bushes picked by eye for vigour and type, the second of transplanted bushes whose yields have been shown to be high and the third will be composed of the progeny of the very best yielders.

The question of quality is under constant consideration and the policy is to search for quality among selected high yielders with a view to getting both desirable characters combined. As far as resources permit, no opportunity will be lost of advancing as quickly as possible on this very important line of investigation. I would like to mention here that the prospects of success have been materially enhanced by Mr. Lamb producing a method whereby the leaf from single bushes can be manufactured and tested.

The second line of investigation, namely, the best method of propagation of selected bushes has resulted in sufficient success with rooting cuttings in peatmoss to allow of selected bushes being multiplied for further yield and quality tests. It will also be possible to use the method to produce seed-bearer areas derived from originally a small number of the very best bushes. The method is based upon the use of small portions of "semi-ripe" wood, each bearing one leaf. These are plunged into peatmoss and under carefully controlled conditions very good rooting is obtained. It must, however, be emphasised that the extension of the method to really large scale work will have to be the subject of further work. In particular, hopes of using plants raised from cuttings for ordinary supplying programmes are at present doomed to disappointment on economic grounds.

All difficulties have by no means been overcome, but the method is, I believe, capable of being developed successfully. One of the difficulties lies in the aftercare of freshly rooted cuttings. The young rooted cuttings not only require hardening off with the greatest care but are liable to perish if exposed too early to field conditions. Establishment in the field after a period of growth in bamboo "pots" was very successful, but a recent letter from Dr. Eden tells me that young cuttings transplanted directly to the field have suffered badly from the drought in March of this year.

Labourers with real gardening instinct are very rare, and I would like to acknowledge here the way in which my staff gets down to such work. "Selection" depends upon a large amount of painstaking and intelligent work and but for their keenness the prospects of success would be much reduced.

The third of the tasks mentioned previously was the investigation of problems affecting replanting. Such problems in many aspects fall within the purview of Dr. Eden's investigations upon manures, soils and soil erosion: there remains, however, the question of the plant's responses to variations in spacing and in methods of planting. Two experiments have been laid out: the first is designed to elucidate the possibilities of interplanting old tea with young plants, the effects of collar pruning old tea, and the effects of different spacings: the second experiment is designed to determine whether holing before planting is strictly necessary on land which has been thoroughly disturbed by the uprooting of old tea bushes.

What I have said gives you a brief outline of the work upon which my department is engaged. Turning from that to the subject of future results, you will all, I believe, agree that the policy of the Institute should be extremely cautious as regards selected bushes. It is of no use our distributing material in the early stages of selection work to commercial estates, save for the purpose of observing growth in different districts. To do so too hastily might result in the work being unjustly thrown into discredit, with the result that efforts to improve the type of bush in cultivation would die away. Many years of endeavour will be necessary before large results can even be hoped for, but it will be our policy to make material immediately available to the Industry when its character is found to justify its distribution.

From the foregoing it will be obvious that work of a very distinct type to what has gone before is now in hand and that it is too early to do more than outline the problems and the lines on which they are being investigated. Therefore, subject to your Chairman's permission, I shall be glad to answer as fully as possible any questions upon them.

DISCUSSION

The President opened the discussion by enquiring whether seed from young seed-bearers was as good as that collected from old ones ?

Dr. Tubbs replied that, provided the seed was well filled, he would always prefer the produce of young seed-bearers which had been carefully selected to that of old trees of whose history nothing was known.

Mr. A. D. Gilbert Burnett asked, in the first place, whether the largest bushes were necessarily the best yielding and, secondly, whether growth of the bush was influenced by hormones in the same way as the human body was by those substances produced by the ductless glands ? Could this, rather than a specific disease, be the cause of *Phloem necrosis* ?

Dr. Tubbs, in reply, said that in general it was risky to judge yield by the size of the bush. It was impossible to examine the yield of every bush in a field. For this reason his plan was for the pruners to leave unpruned a considerable number of the largest bushes in the field. From an inspection of the plucking table, those bushes having a dense plucking table were selected for yield tests, and those with gappy tables were omitted, in spite of their being large bushes. Bush size is a useful *preliminary* method of selection only.

Work on hormones had expanded beyond the scope of a layman in the subject, such as himself, but it was generally agreed that there was nothing to justify assuming the existence of ductless glands producing hormones in a plant. Certain substances had a controlling effect on the growth of plants. Such substances had been used in the rooting of cuttings, but, in the case of tea, provided peat-moss was used, there appeared to be little necessity for the use of such substances as heteroauxin.

As regards *Phloem necrosis*, there was no real evidence at present that it was due to a deficiency in the plant, but the possibility of it being due to certain mineral deficiencies was under investigation by Dr. Eden and Dr. Gadd at the moment. In any case it was unlikely to be due to lack of hormones or similar substances in his opinion.

In reply to Mr. George Brown, who enquired whether China jât was specifically different from Assam jât or only sub-specifically, Dr Tubbs said that this question had been a matter of discussion ever since the botany of the tea bush had been studied. It was considered that both jâts belonged to the same species. The answer to be given depended upon what was meant precisely by a sub-species. In his opinion they could not justifiably be separated by any large margin. There was supposed to be a large leafed China jât and, in so far as the China type can vary from small to large leaf, it would be unwise to separate the China variety completely from that of Assam on leaf-size alone. The Institute had been forced to concentrate on the mixed types available in Ceylon. As it was now possible to import into the Island foreign material for research work, certain intermediate types had been obtained from

Indo-China. These might all be termed geographical races of the same species, but all botanists would not agree with him over this !

Mr. George Brown then asked whether it was possible to graft a high jât Assam on to hardy China jât ?

Dr. Tubbs replied that such young grafts had done well up to date, but there was a tendency to shoot from the roots.

The President then thanked Dr. Tubbs on behalf of those present for the interesting address which he had delivered and for having given up his time for the purpose when on holiday.

THE SUPPLY AND USE OF FERTILIZERS IN WARTIME.*

T. EDEN

With the advent of war the fertilizer market has, in common with others, been overtaken by a certain amount of difficulty and confusion. The situation in which we find ourselves was largely predictable, and the Tea Research Institute started more than a year ago to formulate ideas and plans whereby it could play its part in easing the situation in its advisory and consultative capacity. Today I propose to give a brief outline describing the position as it is at present, the possibilities of the future in so far as they can be foreseen, and the action which the Tea Industry should take in order to minimize the dislocation in manuring programmes that must inevitably occur in some degree.

STOCK POSITIONS

There is a normal stock of fertilizers in the Island at present, but there are no special reserves of any note. The Customs returns to date (September 25th) show that during the current year 71,000 tons of fertilizers were imported; this is in excess of imports for the same period averaged over the last two years, by only just over three per cent. This quantity moreover represents just 74 per cent of the total average annual imports for the last two years, so that in respect of total normal needs we are so to speak just abreast of requirements. These stocks will last some months and would ordinarily be supplemented in a normal manner. But at present

* An address given before the Dimbula Planters' Association on October 2, 1939.

we are cut off from some sources of supply and new sources will have to be tapped, or the supply from some existing sources enhanced, if anything like an adequate quantity of fertilizers is to be at our disposal. In this connection it will be as well to analyse our requirements according to type of fertilizer and place of origin in order to see where the shoe pinches.

NITROGEN

The most important of our fertilizer constituents is nitrogen, and this is going to offer the most difficulty. Unfortunately for us, the basic constituent of high explosives is nitrogen, and consequently plants occupied in peace time in producing fertilizers are now differently enagaged. Metaphorically speaking the scriptural exhortation is being reversed and the plough-share is being beaten into a sword. The Government of the United Kingdom has placed an embargo on the export of nitrogen. The seriousness of this will be realised when I tell you that in recent years sulphate of ammonia received in this Island, largely produced in the United Kingdom, and to a minor extent in Germany, represents some 75 per cent of the imported nitrogen. This is a much higher proportion than during the last war at the beginning of which only 17 per cent of the nitrogen in use was inorganic. There are other sources of inorganic nitrogen that can be tapped. Nitrate of soda comes from Chile, cyanamide from Norway and U.S.A. and Japan still exports sulphate of ammonia, but it will take some time to explore and exploit these possibilities. In the meantime recourse will have to be had to oil cake residues and offals, such as fish, that lie near at hand on the Indian sub-continent. With the detailed implications of this I will deal later. In brief it will involve a heavy surcharge on manuring costs. There are no local supplies that are of much use, or available in any quantity. Sediment poonac contains as much nitrogen as groundnut cake on the average, but is more slowly available. It would not be worth using any distance from its origin.

PHOSPHATES

The position as regards phosphates is easier. Mineral phosphates have rapidly gained favour in Ceylon and the bogey of loss of nitrogen from mixtures containing mineral phosphate has been laid, as you will see when you get your next *Tea Quarterly*, now in the press. Our supplies come largely from Egypt and latterly from Tunis. But there are also rich deposits in the Southern Hemisphere from which we have only had driblets so far. Concentrated and ordinary superphosphate may not be so readily available but there seems little to fear in the phosphate position so long as adequate freight is available.

POTASH

European sources of potash in Germany and Alsace-Lorraine have hitherto been worked by an international syndicate. The German deposits which have the largest output will presumably be closed to us unless we can buy in neutral markets. The position in the last war when Alsace-Lorraine was part of Germany was acute. From an annual import of 7,000 tons of potash manures, the quantity fell to a total of less than 750 tons for the three years 1916-18. Fortunately since those days the Dead Sea concession has started and we regularly import muriate of potash direct from Palestine

SUBSTITUTES AND COST INCREMENTS

The prime difficulty is therefore the nitrogen problem, and the question will perhaps be less one of supplies than of price. The fertilizer distributors have suggested that mixtures of the inorganic plus conditioner type should be discontinued, and that a portion (size unspecified and probably liable to fluctuation) of the nitrogen should be supplied as an organic manure. By adopting such a suggestion, which is reasonable, the extra price burden which must fall on manuring operations by virtue of the higher cost per unit of organic nitrogen, would be spread over a considerable period and some sort of stability would be given to costs. Obviously the crux of the matter is the proportion of organic nitrogen to be used. With a view to getting some information on this subject I called for estimates for the St. Coombs manuring programme. This is a sulphate of ammonia, mineral phosphate muriate of potash mixture with a castor cake conditioner. It totals 30 lb. nitrogen, 27 lb. phosphoric acid and 13 lb. potash. At the beginning of September the cost per acre f.o.r. Colombo, making no allowance for mixing charges or discount was Rs. 15.13 per acre. At the end of the month the same mixture was quoted at Rs. 16.00 per acre, an increment of $5\frac{3}{4}$ per cent. In view of prevailing conditions it was not politic to use this inorganic mixture and an alternative was submitted to us containing fifty per cent of the nitrogen in an organic form. The cost of this per acre rose to Rs. 21.90, an increase of just less than 45 per cent in cost over the mixture we were using a month ago. Moreover the alternative mixture was 50 per cent more bulky so that freight charges would increase by a similar percentage. We have seen alternative mixtures containing as much as 75 per cent of organic nitrogen. This will give you an idea of what is in store for estates until some easing of the situation occurs.

This also is a convenient place for me to stress two points; they are neither of them new. You will in the immediate future have put up to you mixtures of curious compositions. They may possibly

be as numerous and startling as the recipes of cocktails ! But the total poundage will mean absolutely nothing. If this war wipes out the nonsensical habit of specifying manurial rations as a "300 lb. mixture" or a "450 lb. mixture" it will have done some good. The only rational way of specifying a mixture is in the comparable terms of nitrogen, phosphoric acid and potash. Similarly, price per ton is no adequate guide unless the comparison is made between mixtures of equal nutrient content and of equal total poundage per acre. By way of illustration, the mixture I have just quoted which involved an increased cost of something like Rs. 6.00 per acre was actually Rs. 9.50 per ton less in cost.

The success or failure of the expedient that has been suggested, *i.e.*, of dilution of inorganic nitrogen doses with the more costly organic forms, will depend entirely on the care and reasonableness with which the proposed dilution is fixed, and on the extent to which the estates and the fertilizer distributors and the technical advisors co-operate. To this end we have suggested through the appropriate channels that there should be established forthwith a consultative committee or conference to act as a clearing house of relevant information so that a common policy for the common good can be followed without neglect of any party's legitimate interests. We have also taken steps to obtain from the Customs detailed information on the arrival of various fertilizers in the Island.

ESTATE POLICY

Finally, there is the question of estate policy in the face of enhanced costs. If the statistical position does not improve markedly with respect to inorganic nitrogen, then on a cost basis alone restriction of manuring programmes will have to take place. There is a tendency to argue that unless one uses a certain quantity of nitrogen (say 25 lb. per acre) one might just as well not use any at all. There is no justification for this. As has been emphasised many times, all the available evidence from India and Ceylon shows that yield increments are proportional to dose. We can therefore be sure of a return even from small rations if reasonably used. It has been shown in our experiments that this proportionality holds good for intervals between manuring up to a year. Many estates work on intervals of less than a year as we do ourselves. It follows from what I have already said that there are two expedients that can be practised: either to cut down the dose and maintain the interval, or maintain the dose and increase the interval. I recommend the latter since it enables further economies in cultivation to be effected and because, if the position improved, it would allow of the normal programme being adhered to. I will give you an example from St. Coombs. The fields which have recently received,

or are due before the year end to receive, their first-year mixture, amount to a quarter of our acreage. They should normally be manured again in 9 months. We propose, funds allowing, to manure the latter with their normal quantities of nutrient and then to await events. If the position improves we may be able to carry on with our programme. If not, then we shall reduce our standards by lengthening the interval to 12 months and, as a last resort employing a smaller dosage. The essential point is that this method enables us to retain our freedom of action in the matter for some months on these fields. My advice is then that you should manure now to the full extent of your cost estimates and save if necessary by lengthening the time periods.

Secondly, to those who are manuring in the first year at about tipping time, I say continue that scheme, and to those who are using pruning mixtures, delay them. In times like these every ounce of manure must pay its way. The evidence I have tabled in support of this policy is being cumulatively confirmed by later results. On any theory that such manuring is manuring for crop to the detriment of wood, it follows that after the increased crop response from delayed manuring has worn off, the growth and crop from such tea should lag behind that of tea receiving the pruning mixture. No such thing has occurred and we are $2\frac{1}{2}$ years from the beginning of the 3-year cycle.

With regard to rested tea, the economy of unplucked bushes is more flavourable than that of tea in bearing, and manuring can reasonably be reduced or even suspended. But periodical pruning of the leaders, say once a year, should not be neglected.

The present is the time to make abundant use of green manures, especially of material grown in ravines and waste places and consequently contributing new nitrogen. I have always maintained that compost making was a matter to be decided on its merits with cost as the first consideration. An increase in artificial manuring costs obviously changes in some cases the perspective in which composting can be viewed. But remember Sir John Russell's warning that you get no more out of compost than you put in. Although there has been disappointment in the use of compost in nurseries and supply baskets, there is no reason to fear ill-effects when used as a general manure. But the compost must be well made from 'outside' material.

The use of waste land for extra green manuring, or in some cases for compost raw material is linked with that of food production. You will be aware of the suggestion, as yet unofficial, that a fixed percentage of the acreage of an estate should be maintained

under foodstuffs of the type of maize, adlay, kurakkan, etc. The wastes from these are valuable composting materials, and in my view, if this scheme materialises, composting will play an essential part in the maintenance of the fertility of such land by returning the residues aforementioned. But since land for foodstuffs will cost money to open and must therefore be pursuaded to give an adequate return, I think it will be found necessary to use artificial manures to some extent on these areas. This must be borne in mind in planning food production on estates.

Nobody can say at the moment how markets will develop. On the most vital of immediate questions, what is a reasonable dilution rate for organic manures I cannot help at the moment because I have no data to go on. We are giving this aspect attention. But if co-operative principles are adopted you will have the satisfaction of knowing that each and all concerned are striving to make a difficult situation as fair and easy as possible. In the meantime we shall be pleased to help any estate in the redrafting of its programme in the light of current affairs.

STUDIES ON THE FIRING OF TEA.—I

J. LAMB

INTRODUCTION

Since the inception of *The Tea Quarterly* various articles dealing with the different aspects of the firing of tea have been published.

The general principles of drying were dealt with at some length by the writer at the Fourth Conference.[1] A series of articles dealing with Fuels for Tea Dryers [2] followed, and the relative costs of firing with various fuels, calculated from the results of exact experiments, were presented in the form of a "Ready Reckoner" in the fourth article.[3] Under wartime conditions the value of these experiments may be greatly enhanced and attention is drawn again to these articles.

At various times references have been made to the fundamental problems connected with the drying operation [4] and to our efforts in connection with the construction of apparatus for exact experiments [5, 6] on firing. This apparatus was finally completed about eighteen months ago and has since been employed in the elucidation of firing problems with a degree of accuracy hitherto unattainable.

Since the apparatus has already been described in the articles quoted above it is unnecessary to do more than give a brief outline of its main features.

1. Steam heating which allows exact control of temperature over the range normally employed for firing tea.

   A steam trap allows a measure of the heat used in any operation to be made.

2. A variable speed fan which allows a wide variation of air flow.

3. A drying chamber with six trays of circular cross section. Each tray is divided by aluminium partitions into four sections of equal area and each section is spread with from six to eight ounces of leaf thus ensuring even distribution of leaf in each tray. A plenum chamber with tubular orifices is embodied in the drying chamber to ensure evenness of air distribution.

4. As a further precaution to ensure stability of the conditions being studied the leaf from the centre section only of each tray is taken for bulking and subsequent report. At least twelve trays are loaded and passed through the machine before an experiment commences. This ensures stabilised conditions throughout any experiment.

OBJECTS OF THE EXPERIMENTS

In the tea drying operation there are a number of variable factors which may affect the quality of the finished product.

1. Moisture content of leaf to be dried.
2. Nature, (*i.e.*, coarse, fine, etc.) of leaf to be dried.
3. Temperature of the air employed.
4. Volume of air employed. The air drawn into the drying machine may also vary in temperature and humidity.
5. Load of leaf, *i.e.*, thick spreading or thin spreading.
6. The period of the drying operation.
7. The moisture content of the product.

In general practice these variables are all subject to some degree of control and the aim of the experiments is to study the methods of control with a view to producing the highest quality of the finished product.

EXPERIMENTAL METHOD

The general principle of the approach to firing problems has been to investigate one factor at a time, keeping all other factors constant as far as practicable.

The ultimate application of the results to general commercial practice has been borne in mind throughout and conditions which are impossible to achieve in full scale dryers have therefore been avoided.

Seven factors have been mentioned above; if each of these factors had only two levels of variation, *e.g.*, high and low temperature, long and short period, thick and thin spreading, etc., there would be in all $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 128$ different investigations to be carried out.

As already stated, however, results of practical value are the immediate object and in view of the fact that modern dryers are designed and constructed to deal with normal variations in the green dhools and are capable of maintaining a constant relation between the rate of air flow and the rate of loading, the most important points for immediate investigation are temperature, moisture content and period.

Accordingly, temperature investigations have now been proceeding for some time and the results form the basis of the first article of this series.

Three levels of temperature were chosen for the experiment. High (210°F.), Medium (190°F.) and Low (160°F.). Since the time factor is a practical consideration in temperature experiments and also a problem in commercial practice when firing temperature is varied (drying is naturally a quicker process at high temperatures than at 160°F. when it becomes exceedingly slow), the experiments were divided into two series to embrace consideration of firing period.

The conditions of all experiments were fixed so that the moisture content of fired teas was of the order 3 to 4 per cent. In one series the constants were time and air flow and the load variable, while in the other series load and air flow remained constant and time was varied.

The supply of leaf was arranged with the aid of the experimental rollers. Well bulked leaf from the same field was withered in three different lots and the charging times staggered so that on each day three experiments, each at a different temperature, could be carried out with the same leaf. The experiments were carried out in groups,

each group covering three days so that the order could be changed as follows:—

1st Day	2nd Day	3rd Day
1st Experiment at 160	1st Experiment at 190	1st Experiment at 210
2nd „ „ 190	2nd „ „ 210	2nd „ „ 160
3rd „ „ 210	3rd „ „ 160	3rd „ „ 190

At the end of each three-day period the experimental leaf fired at each temperature was bulked and graded before the final sampling.

Fermentation times were standardized and the samples were drawn from leaf fired over a set period so that the length of firing did not affect the length of fermentation.

By these various devices the teas from each comparative group varied only in the temperature of firing.

RESULTS

The results now available cover two complete periods, namely the North-East Monsoon 1938 and the Inter-Monsoon Period (April-May) 1939. Some results are available from a South-West Monsoon period (1939) but are not complete owing to the disorganisation consequent upon the outbreak of the war. The South-West Monsoon and the Dry Weather — Flavour Season — are to be covered by future investigations.

Series I.—Load and air flow constant.

Time of firing 160° 42 minutes.
190° 21 ,,
210° 15 ,,

(a). Season — North-East Monsoon.

Temperature °F	Valuations		Analysis						Keeping Quality
	Colombo Cts.	London Pence	Appearance	Colour	Strength	Pungency	Quality	Flavour*	Valuation in Colombo after storage for six weeks Cents
160	+ 0.2	+ 0.5	0	0	0	+1	+1	+1	+ 1.3
190			Taken as standard for comparison						
210	− 3.0	− 0.6	0	0	0	− 2	− 2	− 4	− 1.5

* Flavour only reported in one sample.

(b). Season — Inter-Monsoon (April-May).

Temperature °F	Valuations		Analysis						Keeping Quality
	Colombo Cts.	London Pence	Appearance	Colour	Strength	Pungency	Quality	Flavour*	Valuation in Colombo after storage for six week Cents
160	+ 2.5	0	0	0	0	0	+1	-	+ 0.25
190			Taken as standard for comparison						
210	- 1.0	- 0.3	0	0	0	-1	-1	-	- 2.0

* Flavour absent.

(c). Season — South-West Monsoon.

Temperature °F	Valuations		Analysis						Keeping Quality
	Colombo Cts.	London Pence	Appearance	Colour	Strength	Pungency	Quality	Flavour*	Valuation in Colombo after storage for six weeks Cents
160	+ 3.0	+ 0.4	0	0	+1	+1	+1	-	+ 2.5
190			Taken as standard for comparison						
210	- 1.0	0	0	0	0	-1	0	-	- 1.5

* Flavour absent.

Series II.—Time and air flow constant.

Time of firing was 21 minutes in each case.

The comparative loads were:—

160° $\frac{3}{4}$ lb. per tray.

190° $1\frac{1}{2}$ lb. per tray.

210° $2\frac{1}{4}$ lb. per tray.

Thus at 160° the rate of loading was half that at 190° and $\frac{1}{3}$ that at 210°F.

(a).—Season — North-East Monsoon.

Temperature °F	Valuations		Analysis						Keeping Quality
	Colombo Cts.	London Pence	Appearance	Colour	Strenght	Pungency	Quality	Flavour*	Valuation in Colombo after storage for six weeks Cents
160	+ 1.2	+ 0.5	0	0	0	0	+ 1	+ 1	+ 0.6
190			Taken as standard for comparison						
210	− 2.0	− 0.9	0	+ 1	0	− 3	− 2	− 4	− 1.5

* Flavour only reported in one sample.

(b). Season — Inter-Monsoon (April-May).

Temperature °F	Valuations		Analysis						Keeping Quality
	Colombo Cts.	London Pence	Appearance	Colour	Strenght	Pungency	Quality	Flavour*	Valuation in Colombo after storage for six weeks Cents
160	+ 2.0	− 0.2	0	0	0	0	0	-	+ 2.0
190			Taken as standard for comparison						
210	− 0.5	− 0.26	0	0	0	− 1	− 2	-	− 1.5

* Flavour absent.

DISCUSSION OF RESULTS

Throughout the experiments the teas fired at 190°F. were taken as standard when tasted by teams of Tasters in Colombo and London. As the samples were sent to London by post a further check on keeping quality was provided by storing duplicate samples for six weeks and sending them to Colombo for a second opinion.

The figures given are the averages of a large number of experiments conducted over the entire periods stated. In the course of normal market fluctuations the actual valuations varied considerably and so the average differences are presented with plus and minus signs affixed, the plus sign indicating that teas were valued higher than the standard and the minus sign indicating a lower valuation.

The system of analytical specification has been described in previous articles [7] and in brief it may be said that the standard sample is given an arbitrary ten marks and the characteristics of the other samples are marked up or down on this basis. Thus +1 under Pungency indicates that samples received on the average 11 marks for pungency as against 10 for the degree of pungency in the standard. The sign "0" indicates that there was not any reported clear deviation, on the average, from the standard.

There is a clear indication that Tasters prefer teas fired at 160°F to teas fired at 190°F. and that those fired at 190°F. are preferred to teas fired at 210°F.

On the different bulked lots sent for report the order of preference is expressed in the following figures:—

160°F.	preferred to	190 and 210	on	18	occasions.
190°F.	,,	160 and 210	on	5	,,
210°F.	,,	160 and 190	on	0	,,

The reason for the preference is also shown quite clearly in the above tables and is that pungency, quality, and flavour when present, depreciate with rise of temperature employed by firing. Appearance, colour and strength are not affected to any marked extent.

Both Colombo and London Tasters are in very close agreement over the characteristics of these teas and this, from a scientific point of view, affords more satisfactory evidence than the valuations. Despite market fluctuations in values and requirements the actual valuations however show clearly enough that the effect of firing temperatures is sufficient to affect commercial values and that the differences are not merely academic.

These considerations raise the question of the economic firing temperature. The evidence so far obtained is practically sufficient to condemn firing temperatures above 190°F. The capacity of a firing machine working at 160°F. and turning out leaf fired to 3-4 per cent moisture content is however only about half the capacity at 190°F. Excluding the cost of heating up the dryer, this practically doubles the cost of firing and the enhanced value of the product may not always be commensurate with this additional expense even if the drying equipment is capacious enough to deal with the whole crop at the lower temperature.

Further investigations are necessary to clear up these points as far as is possible with the market value of pungency, quality and flavour ruling at the time of the experiments.

The indications are at present that firing at temperatures as low as 160°F. may only be worth while when quality is in demand and although it is not intended at the present juncture to make hard and fast recommendations these considerations are offered as food for thought. It is of considerable interest to record that substantially similar conclusions have been reached at the Tocklai Experimental Station.[8]

SUMMARY

1. The first results of a series of accurate experiments upon the control of the firing process are described.

2. In two different seasons and over part of a third, it has been found that pungency, quality and flavour when present, depreciate as the firing temperature employed is raised.

3. Appearance, colour and strength are not affected by the normal range of firing temperatures to any marked extent.

4. Similar results were obtained when either load or firing period were varied to compensate for the temperature differences.

5. The differences found were sufficient to affect the market values of the teas and to such an extent that the indications are that firing temperatures above 190°F. are to be condemned. Firing at 160°F. may be economic when quality teas are in demand. Further experiments are proceeding.

REFERENCES

1. *The Tea Quarterly*, VIII, 43.
2. „ IX, 17-24, 48-59, 110-123, 163-177.
3. „ IX, 172.
4. „ X, 65, XI, 95.
5. „ X, 65.
6. T.R.I. Bulletin No. 12, p. 60.
   13, p. 71.
   17, p. 81.
   18, p. 79.
   19, p. 71.
7. *The Tea Quarterly*, X, 57.
8. Indian Tea Association, Scientific Department, Tocklai Experimental Station, Annual Report, Chemical Branch, 1935, p. 37.

GRADING TEA WITH STAMPED ALUMINIUM SIEVES.—II

J. LAMB

In a previous article [1] tests designed to compare stamped aluminium sieves having square perforations, with ordinary brass wire sieves, were reported in some detail.

The results of these tests established the superiority of stamped aluminium due to the comparative smoothness of the surface of the flat aluminium sheet as against the roughness of a wire weave sieve which tends to scratch the surface of black tea particles and cause greyness of appearance. Severe scratching causes loss of soluble material coated on the surface of tea particles and may thus affect liquors to some extent.

Since the article mentioned above was published it has been observed that slight greyness will disappear if the tea absorbs a small amount of surface moisture.

These observations have also been recorded at Tocklai [2] by Harrison who points out that it is inadvisable to grade tea too soon after firing when the surface is brittle. Absorption of a small amount of water apparently renders the surface coating of soluble material less liable to abrasion.

Although the square stamped aluminium sheets have proved very satisfactory in practice, the production of square stamped sheets has been found to be expensive.

The cost of stamping is reduced considerably when the perforations are round instead of square, and we were approached to test circular stamping and to match this form of sieve against standard brass weave sieves.

Some initial difficulty was experienced over the standardization of the circular stamped sieves, since the size and number of perforations and their pattern all affect the mechanical strength of the sieves. These production problems were soon overcome and the sizes given in Table I may be produced in standard form.

TABLE I

Size of Perforation (Diameter in millimetres)		Number of Perforations per square inch.
1	...	288
$1\frac{1}{2}$	...	161
2	...	80
$2\frac{1}{2}$	...	51
3	...	37
$3\frac{1}{2}$	...	30
4	...	24

A series of tests somewhat tedious in nature were then carried out to match the circular stamped sieves against standard brass weave sieves on a mechanical sifter (Michie).

The results are summarised in Table II.

TABLE II

Circular perforation No.	Equivalent range of standard brass mesh	Closest corresponding brass mesh
1 mm.	22-26	24
$1\frac{1}{2}$,,	18-16	18
2 ,,	14-12	14
$2\frac{1}{2}$,,	12-10	12
3 ,,	10-8	10
$3\frac{1}{2}$,,	8-6	8
4 ,,	6	6

Since methods of grading vary a good deal it is not feasible to cover all the possible applications of stamped aluminium sieves in this article. An example must therefore suffice to show how the new material may be adapted to a particular case with success.

Well bulked dhools were employed in all cases described below and equally divided for the purpose of comparing the different sieves. A Mitchie sifter was used in all tests.

(A). BRASS WEAVE SIFTING

Formerly it was the practice in St. Coombs factory to use No. 10 brass wire weave for sifting out F.P. and B.O.P. and a No. 18 sieve for B.O.P.F. When stamped aluminium with *square* perforations replaced brass weave, $2\frac{1}{2}$ mm. and 1 mm. sieves were adopted.

The practice with dhools 1, 2 and 3 was to sift them over No. 10 mesh and the leaf passing over was cut. The leaf falling through went to the B.O.P. fraction. The cut leaf was again sifted over No. 10 and the leaf passing over went to F.P. while that falling through went to the B.O.P. fraction.

(B). STAMPED ALUMINIUM WITH CIRCULAR PERFORATIONS

The problem in this case was to match the grades sifted out on brass weave. No single mesh could be found to match No. 10 brass weave exactly, so the scheme followed was to sift the first three dhools over a 3 mm. sieve and to cut the leaf passing over.

The leaf falling through the 3 mm. sieve was sifted over a $2\frac{1}{2}$ mm. sieve together with the cut leaf to obtain the F.P. and B.O.P. fractions. A $1\frac{1}{2}$ mm. was used to separate B.O.P.F.

It is not intended to describe the rest of the operation as this course will only serve to confuse the main point which is the use of two sieves to match No. 10 brass weave. This artifice causes little additional work but makes a great difference to the "Make" of the teas which was criticised by the Tasters with regard to evenness as well as size when only one sieve was employed.

Table III shows quite clearly that the teas sifted over stamped aluminium were considered superior to those of identical origin sifted over brass weave. The grounds of preference were on quality as well as appearance. This may be explained by the observations given at the beginning of the article.

TABLE III

Grade	Colombo Tasters		London Tasters	
	Stamped aluminium Cts.	Brass weave Cts.	Stamped aluminium Pence	Brass weave Pence
B. O. P.	82	80¼	15¾	15½
F. P.	77¼	76¾	15¾	15½
B. P.	66¾	66	13½	13½
Pekoe	74¾	72	15¼	15
O. P.	79¼	77¾	16¼	16¼
B. O. P. F.	82	80½	16½	16½
"Sale" Average	80½	79	15¾	15½

Table IV contains figures which demonstrate the similarity of the teas in respect to grade out-turns and also the composition of the comparative grades. The comparison between the grades was made by sieving over standard sieves and weighing the various fractions of different particle size.

TABLE IV

Grade	Grade Percentages		Composition of Principal Grades (Per cent)							
	Stamped aluminium	Brass weave	Standard mesh	B. O. P.		F. P.		B.O.P.F.	
				Alumi-nium	Brass	Alumi-nium	Brass	Alumi-nium	Brass
.O.P.	64.5	63.0	Over 5	—	—	12	6		
. P.	11.0	12.5	Through 5 & over 8	15	15	66	75		
.P.	4.0	4.0	„ 8 „ „ 10	32	33	14	12		
.	2.0	2.0	„ 10 „ „ 12	26	27	8	7		
.P.	3.5	3.0	„ 12 „ „ 16	19	19	—	—	26	18
.O.P.F.	11.0	11.0	„ 16 „ „ 20	8	6	—	—	32	32
ust	2.0	2.0	„ 20 „ „ 30	—	—	—	—	36	40
.M.	2.0	2.5	Through 30	—	—	—	—	6	9

REFERENCES

1. *The Tea Quarterly*, X, 191.
2. Indian Tea Association, Tocklai Experimental Station, Proceedings of the Second Annual Conference, 1938, pp. 44 and 46.

A NOTE ON THE MANUFACTURE OF LEAF FROM SELECTED INDIVIDUAL BUSHES

J. LAMB

Two years ago, in the Annual Report for 1937, a reference was made to a method which had been devised in the Biochemical Department for the manufacture of leaf gathered from single bushes. It was explained that the object of the method was to enable the question of quality to be tackled as soon as selection work reached the stage at which other factors besides yield could be taken into consideration.

The selection work of the Plant Physiology Department has now reached this stage and it is intended in this article to give a brief account of the activities of the Biochemical Department in assessing the quality of bushes selected as high yielders. Emphasis must be laid on the fact that the work is in its early stages and that this article is intended solely as a progress report provided for those people who have shown marked interest in this sphere of activities. Such inferences as are to be drawn from the matter are intended as food for thought rather than action. The few results available do not afford any means of developing a sense of proportion, as we have as yet no idea of the extent to which the more extraordinary types of bushes occur in our present fields.

The method used for manufacturing these small quantities of leaf will not be dealt with at any length, and it is sufficient to say that any quantity of leaf down to the bare minimum required for one Taster's cup can be satisfactorily dealt with. The minimum quantity will normally be some 20-40 pieces of flush and since the bushes have already been selected for yield it is hoped that the minimum quantity will always be available. In order thoroughly to test the method, the leaf from four different bushes has been manufactured repeatedly over the past two years. A professional Tea Taster has examined the teas and the conclusion was that they maintained certain characteristics which would only be the result of bush type or jât. Sufficient confidence was thus engendered in the method of manufacture to warrant its application to an attempt to select for quality, from bushes which have been proved high yielders by the Physiology Department.

This confidence has so far been justified by results, especially since it has been found possible to forecast Tasters' opinion, with some considerable success, entirely on the bases of various observations made during the course of manufacture. In short the behaviour of leaf uniform in botanical type is much more rational than the behaviour of the mixed leaf from the huge number of hybrid types which we have to deal with in present day commercial manufacture.

The variations of quality so far encountered have been little short amazing, and few people can have realised the full extent of the heterogeneity with regard to quality which exists in the tea bushes now cultivated in Ceylon. In order to give a clear impression of the extremities of the variations so far encountered, a few types are described below in some detail. The numbers given to types described are only applied for the purpose of this article as so far we have not made any attempt to classify types of quality; it should also be clearly understood that at present there is not any reliable information about the relative proportions of these types in cultivation.

Type 1.—A non-fermenting type which remains green after the most severe rolling and does not show any sign of developing the colour of normal fermented leaf even up to the time when mould growths appear. When fired after allowing a standard period for fermentation, it gives thin worthless liquors.

A few of these bushes in any field will possibly spoil all infusions although some fermentation is induced by contact with juice from other actively fermenting types. The green particles observed in many commercial infusions, the elimination of which has been the object of so many experiments, may originate from bushes of this type.

Biochemical investigations of this particular type have indicated the lack of the normal oxidase system. Peroxidase and ascorbic acid (Vitamin C) are both present.

Type 2.—A type in which fermentation does not appear to be very active under any circumstances. Three variations of this type have been encountered which become evident when fired after a standard period of fermentation.

(a) Giving poor liquors.
(b) Giving a good quality liquor.
(c) Giving a liquor with a distinctive greenish character.

The infusions of these teas are all poor although they may vary in brightness. Liquors are invariably thin but Type 2(b) has notable quality and is remarkable for the association of quality with a poor infusion, a combination which at first puzzled the Taster.

Type 2(c) is not so rational in behaviour as the others and it is not so easy to predict the Tasters' opinion from the observations made during manufacture. This type often has a green, grass-like "nose," but sometimes, apparently owing to the presence of quality in the liquor, the Taster will class the liquor as above average although remarking on the greenish character. Most often, however, the greenish character of these teas is undesirable.

Type 3.—A type which ferments very rapidly and gives excellent infusions with coloury liquors after standard fermentation and firing. The main variations are:—

(a) Good quality.

(b) Poor quality.

Type 3(a) represents a good all-round tea and is probably the variety which will eventually be chosen for clonal propagation. It is, however, possible that a mixture of Types 2(b) and 3(b) when quality and colour are outstanding might give a better liquor than any single clone of Type 3(a). The problem may eventually arise as to whether we are to concentrate our energies on a good all-round type or on separate quality and colour types, should separate material which is outstanding with regard to these two characters be discovered during our investigations.

The presence of quality in Type 3 teas is evident during manufacture by reason of the "nose" on the fermenting leaf. A good nose assuredly indicates the presence of quality, and conversely the absence of any marked aroma in this type enables one to predict that although infusion and liquor colour will be good, quality will be lacking.

In one or two cases a rather interesting variation of Type 3(a) has been encountered where the aroma of the fermenting leaf is very marked in the early stages but disappears before firing which is carried out at the end of a period standard for all these experiments. Separate experiments are to be carried out with this particular leaf since the fermentation may be ultra rapid and constitute a type which would be called Type 4 in the series described above.

Sufficient has been said to indicate the degree of variation in type found in our Ceylon hybrids and to anyone saddled with the task of manufacture, the discernible differences between, say, Types 2(a) and 3(a) when manufactured side by side, are at present very disconcerting. However, should it prove feasible to replant with clonal material in the years to come, the process of teamaking will be simplified and teas improved to an extent which is impossible at present even with the most elaborate machinery the wit of man may devise.

MINUTES OF A MEETING OF THE BOARD OF THE TEA RESEARCH INSTITUTE OF CEYLON HELD 13-10-39

Minutes of a Meeting of the Board of the Tea Research Institute of Ceylon held in the Rooms of the Ceylon Chamber of Commerce, Colombo, on Friday, October 13th, 1939, at 2-30 p.m.

Present.—Mr. James Forbes (Chairman), the Hon'ble the Financial Secretary (Mr. H. J. Huxham), the Director of Agriculture (Mr. E. Rodrigo), the Chairman, Ceylon Estates Proprietary Association (Mr. C. H. Bois), Major J. W. Oldfield, C.M.G., O.B.E., M.C., M.S.C., Messrs. I. L. Cameron, J. D. Hoare, J. C. Kelly, T. B. Panabokke, S. F. H. Perera, Gordon Pyper, and Dr. R. V. Norris (Director and Secretary).

A letter was received from Mr. R. C. Scott expressing inability to attend the meeting.

1. The Notice calling the Meeting was read.

2. The Minutes of the Meeting of the Board held on 13th July, 1939, were confirmed.

3. MEMBERSHIP OF THE BOARD AND SUB-COMMITTEES

Board.—Reported that Mr. R. C. Scott had resumed his seat on the Board on his return from leave, *vice* Mr. C. M. W. Davies.

THE CHAIRMAN thanked Mr. Davies for his services while acting.

Estate and Experimental Sub-Committee.—The Board nominated Mr. Gordon K. Newton as a Member of the Estate and Experimental Sub-Committee, *vice* Mr. C. Huntley-Wilkinson vacated.

4. FINANCE

(a) The Institute's Accounts to the 31st August, 1939, were approved on the motion of Mr. J. C. Kelly, seconded by Mr. I. L. Cameron.

(b) THE CHAIRMAN reported that the interest and capital payments due on the Government Loan were duly met on the 27th September.

(c) A revised forecast of receipts and expenditure for 1939 was tabled. The Chairman said that reduced profits on estate account due to low crop figures would, it was expected, be balanced by savings in other directions. The final position at the end of the year would be very much the same as that given in the original forecast presented with the estimates.

The Board accepted the statement.

(d) *General Financial Policy for 1940.*—A statement prepared by the Director was tabled.

(i). THE CHAIRMAN said the matter had been considered by the Finance Committee which recommended that the rate of restriction as from 1st April, 1940, should be taken as 92½ per cent. This was approved.

(ii). The Committee had also approved the Director's proposals that, while avoiding any expenditure both under revenue and capital accounts not immediately essential, the normal programme of work should so far as possible be maintained.

The Board approved of this policy.

(iii). The Committee had also considered the question of the appointment of an additional research officer for work on *Phloem necrosis*. In response to the Institute's advertisement seven applications had been received in London. This was somewhat unexpected in view of the outbreak of the war. The Ceylon Association had now cabled to enquire if the Board wished to proceed with the scheme.

The view of the Finance Committee was that the technical points of the scheme remained unchanged and they had therefore considered the appointment mainly from the financial aspect, particularly in regard to the desirability or otherwise of increasing the Institute's commitments during the war.

In the opinion of the Committee, the appointment could be financed and they unanimously recommended to the Board that the appointment be made.

THE CHAIRMAN reminded members that the candidates would be interviewed by a Selection Committee consisting of Sir Frank Stockdale, Sir John Russell, and Professor Engledow. They could rest assured, therefore, that no one but an entirely suitable man would be recommended.

Mr. Cameron strongly supported the recommendation of the Finance Committee.

After further discussion the Board unanimously decided to proceed with the appointment of a research officer for work on *Phloem necrosis*.

(e) The Board approved an extra vote of Rs. 60 under vote 73, Research Revenue Account, being the cost of a caretaker for the Plant Physiologist's bungalow for the term October-December, 1939.

5. ST. COOMBS ESTATE

(a) *Sale of St. Coombs Tea Crop.*—The Chairman reported that a tender of 30,000 lbs. tea had been made to the Tea Commissioner and had been accepted by him. The balance of the crop would be sold in the usual way on the Colombo market.

In reply to Mr. Pyper, the Chairman said owing to the outbreak of war, the Clivemeare experiment, so far as commercial manufacture was concerned, had been suspended. One Clivemeare invoice, No. 14, had been shipped, but no useful market information would now be obtained. A second Clivemeare invoice had been sold locally. B.O.P. had sold for Rs. 1.07 and F.P. for Rs. 1.15, but these prices had little significance under present market conditions.

(b) *Extra votes.*—The Board sanctioned the following additional votes on estate account:—

(i). Rs. 480 being cost of installing extra liquid fuel tanks.

(ii). Rs. 587 to meet increased cost of manure required to complete the cultivation programme for 1939.

(c) *Food Production.*—The Chairman said the question of food production on St. Coombs had been under discussion between himself and the Director.

The Institute was rather different from an ordinary estate and he thought a lead should be given in the matter.

It was suggested that 1 acre should be put down under roots and nursery trials carried out with other crops to ascertain what varieties would be suitable for the conditions at St. Coombs.

If such trials were successful he suggested that an area of 10 acres might later be opened up for food production.

The Director said that in any food production scheme adequate steps should be taken to avoid soil erosion. A rotation would also

be essential. It was also probable that satisfactory crops would not be obtained without manuring.

It would not be feasible to do anything on a large scale before the spring but, in the meantime, the nursery experiments suggested should give valuable information in regard to the right type of crop to grow and the time required for different varieties to mature. In this way mistakes and waste could be avoided if a larger block were opened later. The Institute was in close touch with the Agricultural Department and had been promised every assistance in regard to seed supplies and advice.

After further discussion the Board approved the proposal to open 1 acre under roots and to conduct nursery trials with a view to larger scale work in 1940. A sum of Rs. 100 was sanctioned for this preliminary work.

6. JUNIOR SCIENTIFIC STAFF

The appointment of Mr. F. D. Tillekeratne as Small-Holdings Advisory Officer, Baddegama, was confirmed as from 31st August, 1939.

7. RESEARCH ON THE CHEMISTRY OF TEA

The Board confirmed the payment to the Ceylon Association in London of £187-10-0 being cost of the Joint Scheme for the first six months of 1940. This had been already approved by circulation of papers (Circular No. B1/39 dated 3rd August, 1939).

The Chairman said no information was yet available as to the effect the war would have on the scheme.

8. ANY OTHER BUSINESS

(a). *Visit to Assam.*—Reported that the visit of the Chairman and Director to Assam had been abandoned on account of the war.

(b). *Conference Committee.*—Reported that the Planters' Association of Ceylon, and the Ceylon Estates Proprietary Association had both approved the Board's proposal, *vide* Minutes of July 13th.

ROLAND V. NORRIS,
Secretary.

NOTICES.

The Institute's Laboratories and Offices are situated at St. Coombs, Talawakelle, and all applications and enquiries should be addressed to the Director, Tea Research Institute, St. Coombs, Talawakelle.

Specimens and other consignments sent by rail should be forwarded to Talawakelle Station c/o Messrs. M. Y. Hemachandra & Co., Forwarding Agents. *Carriage should be pre-paid.*

Visitor's Days.—The *second* and *last* Wednesdays in each month have now been set aside as Visitor's Days at St. Coombs Estate and also at the T. R. I. Sub-Station, Gonakelle Estate, Passara, when it is hoped anyone interested will visit the Stations.

Visitors at other times are welcomed, but it is requested that an appointment be made if possible.

RULES FOR THE OCCUPATION OF ST. COOMBS GUEST HOUSE

(1). The Guest House is normally intended for the use of persons visiting the Institute and St. Coombs Estate on business. Children can in no circumstances be accommodated.

(2). Permission to occupy a room for the night must be obtained from the Director in writing and, unless sufficient notice be given, accommodation cannot be guaranteed. Two double rooms are available for the use of visitors accompanied by their wives.

(3). All visitors must sign the Visitors' Book on arrival.

(4). A bedroom may not be occupied for more than one night if required by another visitor. This shall not apply to Members of the Board or of Committees meeting at St. Coombs who shall also be entitled to priority in the allocation of accommodation when on official business.

(5). Complaints or suggestions shall be entered in the book provided for the purpose and not made to the Guest House Staff.

(6). All payments due for services rendered shall be made in *cash* to the steward-in-charge and a receipt obtained from him on the official form. The scale of approved charges is posted in the building. The steward is forbidden to give credit or to accept cheques.

(7) Liquor is supplied for consumption *in the premises only*.

(8). The Institute accepts no responsibility for cash, jewellery or other valuables of any kind left in the Guest House.

(9). All breakages will be charged for at cost price.

ROLAND V. NORRIS,
Director.

The Tea Research Institute of Ceylon.

BOARD OF CONTROL

(A) Representing the Planters' Association of Ceylon:—

(1) Mr. R. G. Coombe.

(2) Mr. Jas. Forbes, (Chairman)

(3) Mr. J. D. Hoare (on leave) Mr. R. Gregor (acting)

(B) Representing the Ceylon Estates Proprietary Association:—

(4) Major J. W. Oldfield, C.M.G., O.B.E., M.C.

(5) Mr. I. L. Cameron

(6) Mr. J. C. Kelly

(C) Representing the Low-Country Products' Association:—

(7) Mr. S. F. H. Perera

(D) Representing the Small-Holders:—

(8) Mr. T. B. Panabokke

(E) Ex-Officio Members:—

(9) The Hon. the Financial Secretary

(10) The Director of Agriculture

(11) The Chairman, Planters' Association of Ceylon

(12) The Chairman, Ceylon Estates Proprietary Association

Secretary, Roland V. Norris, D.Sc., St. Coombs, Talawakelle.

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The publications of the Tea Research Institute will be sent, free of charge, to Superintendents of Ceylon tea estates, over 10 acres in extent, and to Estate Agencies dealing with Ceylon tea, if they register their names and addresses with *the Director, Tea Research Institute of Ceylon, St. Coombs, Talawakelle.*

Other persons can obtain the publications of the Institute on application to the Director, the subscription being Rupees fifteen per annum for persons resident in Ceylon or India, and £1-5-0 for those resident elsewhere. Single numbers of *The Tea Quarterly* can be obtained for Rs. 2-50 or 4*s*. In the case of Indian cheques four annas should be added to cover commission.

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